AMERICAN INTELLIGENCE.

ORIGINAL COMMUNICATIONS.

Abstract of Experiments upon the Physical Influences exerted by Living, Organic and Inorganic Membranes upon Chemical Substances, in Solution, passing through them by Endosmose. By JOSEPH JONES, A. B., Student of Medicine in the University of Pennsylvania. (With a Plate.) Read before the Academy of Natural Sciences, Philadelphia, Oct. 25, 1854. Communicated by the Author.

The phenomenon of endosmose is coeval with that of life. All organized beings spring from organic cells. Each cell is a chemical laboratory; the materials for its nutrition, growth and elaboration all pass through its walls by endosmose. What is true of the organic cell, is also true of every living organism, however simple or complex, because all its acts of nutrition, secretion and growth, are carried on by organic cells. These facts show the important bearing of endosmose upon physiology and pathology, and demonstrate the absolute necessity of studying and understanding its phenomena, and developing, as far as possible, all its physical laws.

A true knowledge of these can only be gained by careful, laborious, and numerous experiments.

Experiments upon Living Animals, showing that their Membranes exert a Physical Influence capable of changing the molecular arrangement of Chemical Substances in solution, passing through them by Endosmose.—I immersed the belly and lower extremities of a large spring-frog, in a strong solution of the chloride of calcium, and allowed it to remain for an hour; then washing it carefully with water, immersed its lower extremities in a strong solution of the oxalate of ammonia. It remained in this solution for one hour, when it was again carefully washed and placed in the solution of the chloride of calcium, where it remained for a similar length of time. Finally, it was removed from this, back to the solution of the oxalate of ammonia.

During the course of the experiment, which lasted four hours, the frog gradually became weaker and more inactive, and finally died in the solution of the oxalate of ammonia in which it was last placed. The specific gravity of the solution of the oxalate of ammonia was much less than that of the chloride of calcium, consequently the object in moving the frog from one solution to another, was to obtain as large a deposit of the oxalate of lime within its bloodvessels and tissues as possible, by promoting the actions of imbibition, endosmose, and exosmose.

As a general rule, the rapidity of the action of endosmose is proportional to the difference of the densities of the exterior and interior fluids. The effects of this action, or rather of the membranes, upon the chemical substances passing through, will be manifested by the change of physical form exhibited by the precipitate of the oxalate of lime.

Immediately after the frog had been removed from the solution of the oxalate of ammonia, an incision was made below and to the side of its sternum,

into the cavity of the thorax and abdomen. The heart was found still pulsating. The bloodvessels beneath the skin, upon the surface of the stomach and intestines, in the muscular fold of the peritoneum, and between the kidneys, appeared thoroughly injected with blood, as if the animal had died of violent inflammation of all these parts.

The blood from the heart and lungs was first examined under the microscope, in which, with a magnifying power of 210 diameters, were seen innumerable minute cubical particles, floating amongst the large elliptical blood corpuscles. In the fibrous tissue between the epidermis and pectoralis major muscle, square plates, cubical crystals, and parallelograms were seen, together with minute particles, the largest of which appeared to be cubes.

The mesenteric fold of the peritoneum contained the same equilateral, equiangular plates, and cubical crystals. In the fascia of the thigh, besides numbers of these, there appeared, also, beautiful octohedral crystals of the oxalate of lime, similar in all respects to those formed when the intestines of a raccoon (*Procyon lotor*) were filled with a solution of the chloride of calcium, and immersed in a solution of the oxalate of ammonia.

When the eggs of the frog were mashed, and their contents spread out on a glass slide and examined under the microscope, they contained multitudes of equi-angular plates, and cubical crystals of the oxalate of lime. It is probable that the exterior fluids passed through the anus and cloaca into the oviducts and ovaries, and finally by endosmose into the eggs themselves.

In the fibrous tissue of the walls of the abdomen, in addition to the cubes and octohedra, and equilateral plates, there appeared, also, delicately formed dumb-bell and ellipsoidal crystals.

When the plantar fascia of the foot was cut through, from the incision flowed a fluid resembling the liquor sanguinis mixed with a little blood, which, under a magnifying power of 210 diameters, contained beautiful octohedral and dumb-bell crystals of the oxalate of lime.

This experiment was repeated, with slight variations as to the length of the time and the density of the fluids, and in every instance, without any exception, the results were the same.

In one instance, the deposit formed within the blood and tissues of the frog assumed the form of delicate dumb-bell and cruciform crystals of the oxalate of lime. Fig. I. represents the appearance of these crystals and their relative size, when compared with the blood corpuscles. In another experiment the blood from the ventricle of the heart contained large and perfectly formed octohedra, with a few dumb-bell crystals, while the various tissues and muscles contained chiefly delicately formed dumb-bell crystals, and the aqueous humour of the eye contained octohedral, and comparatively large acicular crystals.

Fig. II. represents the crystals from the blood of the heart.

Fig. III. those found in the tissues, and between the fibres of the muscles.

Fig. IV. the acicular and octohedral crystals found in great numbers in the aqueous humour of the eye.

We see, then, by these microscopical examinations, that the oxalate of lime has assumed forms different in all respects from those of the precipitate thrown down, when solutions of the chloride of calcium and oxalate of ammonia are brought into immediate contact. The precipitate thus formed consists of minute irregular granules. Fig. V. represents this deposit. What has changed the physical form of this deposit? It has been accomplished, without doubt, by the action of the membranes upon the chemical substances in solution passing through them.

Experiments upon the Physical Influence exerted by Mucous Membranes, removed from all vitality, upon chemical substances in solution passing through them.—I filled the intestine of a raccoon (*Procyon lotor*) with a solution of the chloride of calcium, whose specific gravity was 1031, and immersed it in a solution of the oxalate of ammonia, having a specific gravity of 1007. In the course of an hour the exterior fluids became cloudy, with a white precipitate of the oxalate of lime. At the end of two days, a copious white deposit had settled to the bottom of the jar, which, under a magnifying power of 210 diameters, presented the appearance of innumerable acicular, rectangular, and irregular particles, often conglomerated together in great numbers, forming miniature representations of plants with their branches and leaves. Fig. VI. represents their appearance.

Specific gravity of exterior fluid 1005.

The interior fluid was next examined, the intestine having been punctured and its contents carefully removed.

Specific gravity of interior fluid 1003.

This marked change of its specific gravity from 1031 to 1003, shows that a free interchange of the fluids must have taken place. The slight change in the exterior fluid, of 1007 to 1005, is readily explained, when we consider the fact, that the exterior was 12, whilst the interior was only 4 fluidounces.

Within the intestines but a small deposit had taken place, in comparison with that of the exterior fluid. Under the microscope this presented a magnificent crystalline appearance, differing wholly from that of the exterior fluids, and also from that formed when solutions of the chlorides of calcium and oxalate of ammonia are brought into immediate contact. The appearance of this magnificent microscopical object is represented in Fig. VIII.

Amongst the crystals there were no less than seven well defined regularly formed varieties. We recognize the octohedral and dumb-bell crystals, as the form in which the oxalate of lime almost invariably occurs in the urine, not only of man, but also of other animals, and even in that of birds.

Does not this experiment indicate that the peculiar forms of the oxalate of lime, occurring in urine, may be the result of the physical action of the basement membrane of the tubuli uriniferi and its secretory cells?

The tissues of the intestine were next examined.

The cellular tissue was not equally injected; in some places there was scarcely any, while in others there was a very abundant deposit.

In all places the mucous membrane appeared free from any deposit of the oxalate of lime. It was found difficult, however, to decide this question by the microscope, on account of the difficulty of separating the fibrous tissue completely in which occurred a copious crystalline deposit.

This is not the only instance; out of numerous examples, we will select the following:—

When the bladder of a raccoon (*Procyon lotor*) was filled with a solution of the bichloride of mercury, and immersed in a solution of the iodide of potassium, a brilliant red crystalline deposit of the biniodide of mercury took place upon the exterior, whilst upon the interior a light yellow mass of lozenge-shaped crystals of the protiodide of mercury was precipitated. In this case also the mucous membrane appeared free from any deposit.

When the intestines of a raccoon were filled with a solution of the acetate of lead, and immersed in a solution of the bichromate of potassa, the deposit upon the exterior consisted of innumerable small irregular granules, while that upon the interior consisted of beautiful stellate crystals.

When a sheep's bladder was filled with a solution of the oxalate of ammo-

nia, and immersed in a solution of the chloride of calcium, no deposit took place in the exterior fluid, whilst a precipitate of the oxalate of lime fell in the interior fluid.

The appearance of this under a magnifying power of 210 diameters, is represented in Fig. X. Within the muscular and fibrous coats of the bladder this deposit presented the same appearance. The fact that solutions of certain chemical substances will pass through a membrane in one direction, but not in another, might be illustrated by many examples.

The stomach of a raccoon was filled with a solution of the bichromate of potassa, and immersed in a solution of the acetate of lead; a copious deposit of the chromate of lead took place in the exterior fluid, whilst none whatever occurred in the interior; it retained its natural color and appearance. The results were in all respects the same when the intestines of this animal were treated in a similar manner.

When the stomach was treated in this manner a deposit took place only upon the interior. When the œsophagus of a large rattlesnake (*Crotalus adamanteus*) was treated in a similar way, only a small deposit occurred in the exterior fluid.

I filled the stomach of a raccoon, and a portion of the intestines of a large rattlesnake with a solution of the iodide of potassium, and immersed them in a solution of the bichloride of mercury; in both cases a copious deposit occurred upon the exterior, whilst little or no precipitate fell in the interior fluid.

These facts are due to one of two causes. Either certain chemical substances in solution exert an influence upon mucous membranes, changing their minute anatomical structure, and thus destroying their power of carrying on the physical phenomena of endosmose and exosmose; or else mucous membranes possess a power of choice, as it were, dependent upon their physical constitution, allowing one fluid to pass through in one direction, but not another fluid holding a different chemical substance in solution in an opposite direction. When a portion of the small intestine of a sheep was filled with a solution of the nitrate of lime and immersed in a solution of the oxalate of ammonia, a copious precipitate of the oxalate of lime took place in the exterior fluid, which under a magnifying power of 210 diameters was found to consist of innumerable octohedral crystals of different sizes, also a few dumb-bell crystals. The appearance of this deposit is represented in Fig. VII.

In the exterior deposit the octohedra were about one hundred times more numerous than the dumb-bell crystals.

In the interior fluid a deposit of the oxalate of lime had taken place, which under the microscope presented the appearance represented in Fig. IX. The entire deposit consisted of innumerable minute and delicately formed dumb-bell crystals, with here and there an octohedral crystal. In the interior fluid, unlike the exterior, there were over a hundred dumb-bell crystals to one octohedral crystal. Minute octohedra, and delicately formed dumb-bells, were found within the meshes of the fibrous tissue. By comparing this experiment with the former ones in which solutions of the same chemical substances were used, we are forcibly taught the following laws:—

1. Mucous membranes from the same relative part of the bodies of different animals, exert different physical influences upon the same chemical substances.

2. Mucous membranes from the same animal, but from different parts of the body, exert different physical effects upon solutions of the same chemical substances.

Fig. I

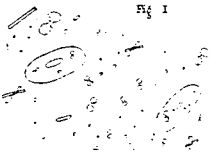


Fig. II.

Fig. III.

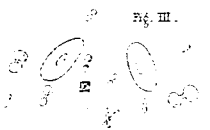


Fig. VI

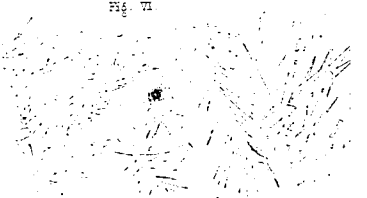
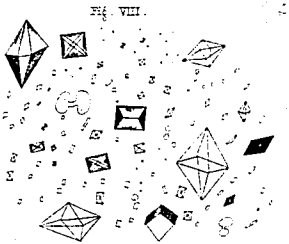


Fig. VIII.



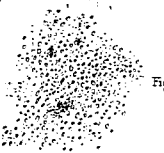


Fig. V.

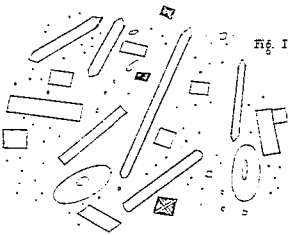


Fig. I

Fig. VII.

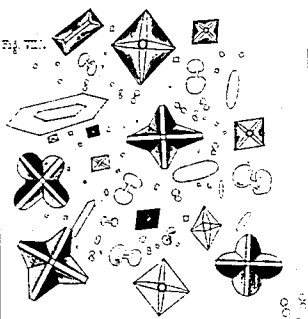
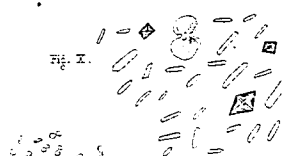


Fig. X.



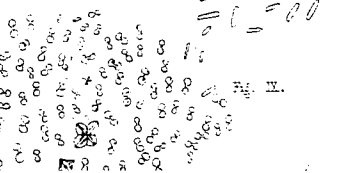


Fig. IV.

Fig. II.

3. The physical influence exerted by the membrane is not the same in endosmose and exosmose; it differs with the direction of the current.

A very important question now presents itself for our consideration. May not this change of form in the precipitates be due to the presence of some animal substance or fluid, as fibrin, blood, albumen, or serum, and not to the physical action of the membranes? To determine this point a series of careful experiments were instituted with the following substances; albumen, fibrin, yolk of hen's egg, warm blood, cold blood, putrescent blood, warm serum, cold serum, putrescent serum, and urine. In no case did the presence of these substances produce a crystalline deposit of the oxalate of lime. Each experiment was performed in several different ways, and under different circumstances; sometimes the densities of the solutions of the chloride of calcium and oxalate of ammonia were varied, at others the temperature and conditions of the foreign body. But one result attended all these experiments—no crystalline deposit. In many instances we have mingled the interior and exterior fluids, in both of which crystals had been produced by the action of the membrane, and in every case the precipitate of the oxalate of lime thrown down consisted of irregular granules without any crystalline form whatever. Does not this prove conclusively that the simple presence of the different membranes did not cause the change of the physical form of the precipitate?

The next question which presented itself was, whether dry membranes exert a physical influence upon substances passing in solution through them, capable of changing their physical forms? To determine this point we performed several experiments with dry membranes, with solutions of the chloride of calcium and oxalate of ammonia, varying the relative positions and densities of the fluids in each experiment. In no instance was a regular crystalline deposit obtained. In only one experiment two or three octohedral crystals occurred in the midst of millions of irregular particles.

All our experiments, thus far, prove that dry membranes exert little or no physical influence upon chemical substances in solution passing through them.

Our next subject was to ascertain the influence of inorganic septa, during the endosmotic action. In our experiments we used thin vessels of baked clay. These were filled with a solution of the chloride of calcium and immersed in a glass jar containing a solution of the oxalate of ammonia. The relative positions and densities of these fluids were also changed. In no instance did we obtain a regular crystalline deposit. So far, then, as our experiments go, we are able to assert, that inorganic septa do not exert a physical influence upon chemical substances passing through them, capable of changing the arrangement of their molecules.

Experiment upon the Physical Influence exerted upon Chemical Substances in solution, as they pass through the cell walls of vegetables.—I immersed the cut end of a stalk of Indian corn in a solution of the chloride of calcium, and allowed it to remain for 18 hours, at the end of which time it was removed and placed in a solution of the oxalate of ammonia, in which it remained for a similar length of time. When thin slices of the corn-stalk were examined under a magnifying power of 210 diameters, a crystalline deposit of the oxalate of lime was found to have taken place within the hexagonal cells of the vegetable, which presented the appearance represented in Fig. XI. This differs widely from the deposit formed when solutions of the oxalate of ammonia and chloride of calcium are brought into immediate contact. The precipitate thus formed consisted of irregular granules.

The crystals deposited within the cells of the corn, differed widely also from those formed when the intestines of a raccoon or a sheep were filled

with solutions of the oxalate of ammonia, and immersed in solutions of the chloride of calcium.

I immersed sections of different lengths of the stem of a young and verdant benne plant, in a solution of the acetate of lead, and then transferred them to a strong solution of the proto-sulphate of iron. When thin sections were examined under the microscope, beautiful square and lozenge-shaped plates had crystallized in all the hexagonal cells.

When the broad thick leaf of an endogenous plant was placed alternately in solutions of the same chemical substances, a crystalline deposit took place within its cells, which differed in form from that within the cells of the benne plant. Different vegetables were immersed in different chemical solutions, which, when mingled, produced a deposit of irregular granules, and in every instance a regularly crystalline deposit took place within their cells.

It is unnecessary to do more than recapitulate the following results:—

1. Cell-walls, like animal membranes, exert a physical influence upon the chemical substances held in solution passing through them. This physical influence is capable of altering the arrangement of the molecules of the precipitate formed within the cells, so that the precipitate which under ordinary circumstances consists of irregular granules, under the influence of the endosmotic action assumes a regular crystalline form.

2. The cells of different vegetables, like different animal membranes, change in different manners the arrangement of the molecules of the same substance.

It may yet be demonstrated, by experiment, that cells in the same plant, having different offices, elaborating different products, exert a different physical influence upon the same chemical substance. Or, in other words, the crystalline deposit of the same substance, will vary in physical properties with different cells.

In conclusion, we would state that we are still investigating this subject, and hope to be able to substantiate, by numerous experiments, performed under every possible circumstance, all the laws and facts asserted in this brief abstract of experiments.

Case of Quadruple Birth.—By Wm. Rankin, M. D., of Shippensburg.—*April* 20, 1854. I was called to visit the wife of Mr. John Tarvin, farmer, who is supposed to be in labour, having completed the full term of her fourth pregnancy. On my arrival, I found a child delivered; but on examination, ascertained that there was another contained in the uterus. After waiting nearly an hour from the time the first child was born, for further uterine contractions, I ruptured a set of membranes that presented in the form of a pouch at the os uteri, when a pain came on and delivered another child. On examination over the region of the uterus, I discovered the presence of another child; and no pain coming on, after a reasonable delay, I ruptured a third set of membranes, when a powerfully expulsive contraction took place and expelled a third child. From the usual examination, I ascertained that there was yet another child to be delivered; and no pains coming on, I resorted to the plan of rupturing the membranes, when almost immediately a pain occurred and effected the delivery of a fourth child. By a little manipulation over the region of the uterus it contracted and expelled from its cavity two placentæ, to one of which three cords were attached, and to the other but one; the whole mass not larger, I think, than I have often seen after the delivery of one child. The cords were something smaller than the average size. The uterus afterwards contracted well, and there was no more hemorrhage than takes place after the majority of cases of parturition. The woman appeared very much exhausted and overcome by distracting emo-

tions in consequence of the enormous brood of children to which she had just given birth; but after encouraging and consoling her, as well as I could, by pointing out her duty in the case and assuring her that there would, undoubtedly, be ample means provided for their maintenance, she soon assumed a cheerful countenance, her general debility gradually abated, and she progressed through her confinement as favourably as most women do after giving birth to a single child.

The first and last born were rather larger than their mates, and were all apparently healthy and viable, and, according to their mother's reckoning, had come to their full time. Although I unfortunately neglected weighing them, I think they would have averaged four or five pounds.

They were all of the male sex. The hair nearly red, and the complexion florid in all of them.

The mother is a woman of slender and rather delicate form, of medium height, and generally healthy, of about thirty-five years old; and, before this quadruple birth, had had three daughters at as many births; five years have elapsed since the last. Her complexion and hair are dark. The father is a stout, athletic, healthy man, of about thirty-eight years of age; hair fair and complexion florid; of sanguine temperament.

The first born of the children, about eight weeks after birth, sickened and died after a few hours' illness, most probably from the almost unavoidable irregularity in giving it nourishment.

After the milk was fully secreted the mother had, for a month or so, plenty of nourishment for them all, after which time food was required from other sources, principally cow's milk diluted with water and sweetened with loaf sugar. The three surviving are now, 14th of January, 1855, quite healthy and thriving children.

Paste of Allium Cepa as a remedy for Epistaxis.—Benj. Rorer, M. D., of Germantown, has favoured us with a communication in which he extols the efficacy of a paste made of the *Allium cepa* in arresting atonic hemorrhage from the Schneiderian membrane.

The directions for making the paste are as follows:—

"Take the inner portions of the bulb of the *A. cepa* or common onion, cut it fine, mix it with an equal portion of flour or bread crumbs, adding a sufficient quantity of strong vinegar to make a consistent paste." This paste is applied by pressing it into the nostril with the ball of the thumb until no more can be introduced, when the plug is to be secured by a bandage. Several cases are detailed illustrative of its efficacy, one of which we shall quote.

G. F., aged 44 years, a baker, was attacked, March 6th, 1847, with epistaxis without any premonition, while attending to his heated oven, and had lost, he stated, 10 or 12 ounces of blood before Dr. Rorer saw him. Dr. R. had him placed in a cool room, washed his face and head with iced water, and injected the same into his nares, and afterwards solutions of alum and of the metallic salts. Alum and finely powdered galls were then applied by means of a quill, and lastly plugging with lint wet with astringent solutions resorted to. At the same time 20 drops of muriated tincture of iron were given every two hours, all without any avail. At this time a German named Seibert advised the onion paste, which was used with the effect of completely arresting the hemorrhage.

Blighted Fœtus at the fifth month retained and expelled with a Living Child at Full Term. By Wm. M. Belt, M. D., of Independence, Mo.—I was called on the 23d day of January, 1852, to see a girl in the employ of

Hiram Young, of this place, supposed to be threatened with abortion. She stated that the waters had escaped; there was slight hemorrhage and strong uterine pains. I kept her in a recumbent position, and gave a mild cathartic. In five or six days she was able to walk about the house, and soon recovered her usual health. On the 21st day of May following, I delivered her of a healthy child. In tracking the cord for the placenta, I came in contact with a *dead fœtus* of five months.

INDEPENDENCE, Mo., *Jan.* 1, 1855.

DOMESTIC SUMMARY.

Peritonitis in Typhoid Fever, without Intestinal Perforation.—The following very interesting case was read to the College of Physicians of Philadelphia, by Prof. G. B. WOOD.

"J. B., aged seventeen years, entered the Pennsylvania Hospital on the 2d of January. According to his own account, he had been three days ill; but the symptoms, which were those of typhoid fever in the middle of its course, evinced that he was in the second week of the disease. The tongue was quite dry, and the abdomen tympanitic; and the characteristic red spots, if not present at the time of his entrance, made their appearance very soon afterwards. Under the plan of treatment usually pursued in the hospital, including the use of oil of turpentine as an alterative to the ulcerated surfaces in the intestinal mucous membrane, he gradually amended; and, on the 20th, I presented him to the class in attendance upon the clinical lectures as quite convalescent. On the 21st, however, he was suddenly seized with severe abdominal pains, tenderness on pressure, and great prostration; and it was evident that he was labouring under an attack of violent peritonitis. I had no doubt of the existence of perforation of the bowel, which I felt disposed to ascribe to an orange which he had surreptitiously eaten a few days previously, and of which, in order to conceal his violation of the rules of the ward, he had probably swallowed the seeds and rind. With this conviction of the nature of the case, I directed the use of sulphate of morphia largely, according to the well-known plan of Drs. Graves and Stokes, with perfect rest, a blister over the abdomen, and, towards the close of the case, stimulants in order to support life. The system never fully reacted, and death took place on the 25th.

"Dr. Forbes, one of the resident physicians of the hospital, opened the body, and found a small quantity of turbid liquid in the abdominal cavity, with evidences of almost universal inflammation of the peritoneum; but, on the closest and most careful inspection, could discover no perforation of the bowel; nor was there the slightest fecal odor in the liquid effused. I had afterwards an opportunity of examining the whole of the intestines, though not *in situ*. The internal surface of the ileum presented several recent and well-defined *cicatrices*, finely marking the boundary of the patches of Peyer's glands, which I exhibited to the class as the finest example I had seen of this appearance; but there was not a single remaining ulcer visible, and I could find no sign of an opening. The peritoneal coating was covered with a very thin, glutinous, and translucent exudation of coagulable lymph, but with little redness. At no one point upon the surface were there more decided marks of inflammation than elsewhere, to indicate the possible seat of an opening. I was compelled, therefore, to regard the case as one of peritonitis without perforation. No discoverable cause of the affection existed; and I am inclined to rank this with those not very uncommon cases, in which peritonitis comes on without any special known cause, at the close of long-continued and exhausting affections, perhaps in consequence of depravation of the blood.

"This case is calculated to throw great doubt upon the existence of intestinal perforation in those instances of peritonitis, occurring in the advanced